Learning disabilities

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Learning disabilities as a name encompasses a wide variety of conditions, from dyslexia to short term memory issues—from difficulty *processing* information that comes into the brain to difficulty *remembering* information that comes into the brain. As a result, there are no "one size fits all" solutions to the variety of problems that people with learning disabilities present. Rather, a solution must be tailor-made to each person. For example, a person who has processing difficulties is going to need extra help on the reading and writing aspects of music, to learn how to process that information. A person who has short term memory problems will need lots of practice and repetition to transfer new information to long term memory. A person with a short attention span may need strategies for breaking down the large task of learning music theory into smaller, do-able units. All of these students may need help with organizing their time and managing their work load, in part because their work load may be larger than the average student and in part because processing and/or memory deficits may also result in poor time management practices.

New technology is available today to help students deal with learning disabilities. Students can offset memory problems by using the technology to record and review information; they can cope with processing difficulties not only by repeatedly reviewing information but also by receiving information in the most comfortable semiotic system for them; they can learn to deal with organization and time-management issues through time-management software.

This paper will summarize information on how learning disabilities appear to affect the brain, review information related to processing deficits, particularly in relation to reading and writing both language and music, since this is where accommodations need to be made in music theory content and delivery. It will briefly review how technology can be used to help students with memory deficits and difficulties with organization and time management. Finally, the paper includes suggestions for how a college music theory course can accommodate the needs of struggling learners.

Definitions

One important starting point is that there is no consistency in terms of what constitutes a "learning disability" and the various possible subtypes of disabilities that have been identified in the research literature (Morris, 1988). This situation creates a challenge for anyone who has an interest in applying the research to real-life situations: how do we know that the people we are dealing with are like the people we have read about in various articles? Nevertheless, it is possible to explore the range of literature and glean from it possible aids and solutions; it is because of the problem of definition and the wide range of difficulties that are encompassed by the idea of "learning disabilities" that I argue later in this paper for the use of technology to create a menu of options from which individual students can choose those that help the most. Klein (2002) has a simple definition of dyslexia (which could be considered a specific learning disability) and that is difficulty reading but no explanation (brain injury, lack of early exposure to literacy, etc.) for that difficulty. In the process of researching for this paper, I deliberately decided to read about both learning disabilities in general and dyslexia

specifically because I wanted to be able to use technology to develop learning materials that would address as wide a range of problems as possible.

Learning Disabilities and the Brain

Numerous studies have shown that people with various learning disabilities have brains that function differently from those who do not have learning disabilities. Imaging technologies have allowed scientists to study the human brain while the person is doing something; these scans show where increased blood flow is during a given task. This information combined with the knowledge of how and where brains typically process given types of information or tasks demands, allows us to understand a lot about some of the differences between people with learning disabilities and those without them.

Mather (2001) suggests that people with dyslexia learn the alphabet in a different hemisphere (the right brain) from non-dyslexics and that this has a profound affect on their processing words and letters. Even a single activity, such as remembering a series of words, can be processed differently, based on how the words are presented, according to Tsukiura et al. (2005). People process words presented with some kind of relationship between them differently from words that are presented with no relationship—different parts of the brain show activity when these people are asked to recognize whether a word has been previously presented. Because reading is both visual and aural, there are two general reading strategies: one is to "sound out" the words (an aural strategy) and the other is to look at the word and remember what it is (a visual strategy). According to Milne et al., (2003), there are differences in the brain functions of dyslexics who differ in relation to preferred strategy.

In addition to different areas where tasks can be processed, some people's brains begin to compensate. Shawitz et al. (2003) found that there were differences in brain processing among people who were poor readers as children and remained poor readers as adults, people who were poor readers as children and became good readers by adulthood ("compensated readers"), and people who were normal readers from childhood.

Not only do people study where in the brain tasks are processed, but they also study how that information is processed. According to Kramer, et al., (2000), there are differences between people with reading difficulties and people without reading difficulties in terms of how they remember information. People with reading difficulties appear to have trouble encoding written information in their long term memories.

Another aspect of processing in the brain is the speed with which it is done. Tallal (2003) found that people with dyslexia process aural information more slowly than people without it. She reports on the development of computer games to help people learn to process information quickly and that this led to the development of brain images in her subjects that began to resemble normal brain images in processing.

Not only is the human brain complex, but what constitutes a learning disability is also complex. This means that we have a long way to go before we truly understand all there is to know about the normal brain and the brains of people with the various differences that get labeled as "learning disabilities." Nevertheless, what we do know is that there are tangible differences in learners—that people with learning disabilities appear to process information more slowly, in different (less efficient) parts of the brain,

and that they may not be able to place information in their long term memories as easily as people who do not have learning disabilities.

Learning Disabilities and Music

Music teachers and researchers have written about people with learning disabilities and various musical aspects. Researchers tend to use musical concepts in order to tease out more understanding of how the brain works, particularly in reading language. For example, Johansson (2006) discusses dyslexia across a variety of language types (alphabetic and idiogrammatic) and includes research about music and dyslexia only in relation to the process of learning to read in a given language. Johansson states that people with dyslexia have difficulty with aspects of timing in music. Mather (2001) in noting his finding of two types of dyslexics, that the visually-oriented readers (who look and recognize words visually rather than sounding them out aurally) have difficulty singing melodies they have heard.[1] Klein (2002) used a metronome to explore temporal processing difficulties of people with learning disabilities and found that people with dyslexia had difficulties changing tempos with the metronome.[2]

Music teachers tend to recognize the challenges of learning disabilities among music students, e.g., Johnson (2001) who reviews research on dyslexia for music teachers. They also recognize the talents of music students with learning disabilities and the need to provide appropriate instruction for them. M.T. (1996) includes accounts by students with dyslexia about the importance of music in their lives. Allan and Cope

[1] My husband is dyslexic and probably a visual reader. He, indeed, does have trouble reproducing melodies on the instruments he plays (fiddle, banjo, guitar, mandolin). He produces the correct chord changes but frequently will not produce the exact melody. He begins on a chord tone, but sometimes not on the correct chord tone for that melody.

[2] This does not appear to be a problem for my husband, who is a believer in the importance of practicing with a metronome. But he has been working with one for years and has learned how to use it and Klein's subjects probably had not been using a metronome in the past.

(2004) describe a Scottish fiddle group that includes students with dyslexia. They argue in favor of including students with dyslexia in musical groups.

Linguistic and Musical Literacy

In order to understand reading and writing problems, we must understand what it is to read and to write. Once we know what the tasks are, then we can begin to figure out strategies for helping students who struggle.

Reading

Most of the dyslexia research takes place in the context of reading language, so a review of concepts related to the task of reading may shed light on the reading of music. Martin, Pratt, and Frasier (2000) define reading:

> In order to read, a person must be able to integrate information rapidly and efficiently from the printed page using cognitive, visual, auditory and linguistic processes. The identification of printed words, the basis of all reading, can involve orthographic decoding based on the sequence of letters or graphemes, or phonological decoding based on knowledge of letter-sound or grapheme-phoneme correspondences and blending (p. 232).

This passage suggests that there are two basic ways of reading: one which is centered on visual pattern recognition (orthographic—spelling pattern recognition—decoding) and one which focuses on the connection between what is on the page and how it sounds (phonological decoding). The same two methods of decoding can be found in music. When a student recites “Every good boy does fine” and determines that a note on the

bottom line in treble clef is an E therefore, that student is using a visual means for determining what note is to be played or sung; it is likely that the student is not hearing the note mentally. When, in contrast, a student is reading a scalar pattern without necessarily knowing the names of the notes (e.g., reading in a new clef), then the student is focusing on the sound (the scale) and this would be a more aurally-centered form of reading. As has been seen, the two forms of reading suggest that there are at least two forms of dyslexia—and this will be significant in terms of music teaching as well.

While we tend to think of reading as reading as reading, in fact it turns out that reading is a different task depending on the language one is reading. Some languages use ideograms, such as Chinese where each symbol refers to a different word and there is no relationship between the written word and the sound of the word. Some languages are alphabetic but very regular in spelling, such as Italian and Finnish. According to Ziegler and Goswami (2005), 7-year-old Finnish children learn to read with 90% accuracy in approximately ten weeks because of the regularity of the language. Finally, some languages, like English, are alphabetic but very irregular in spelling (due, in part, to being a Germanic language with plentiful borrowings from Latin via French and Greek). Because of the importance of reading, especially in a highly technological culture, and the challenge of reading an irregular language, reading instruction in English has been pushed back from first grade a generation ago to pre-school.

The variations among alphabetic languages have led Ziegler and Goswami (2005) to propose a "psycholinguistic grain size theory" (p. 3). More regular languages have a smaller, easier grain size, as Davis (2005) points out:

There are more orthographic units to learn when the grain size is big than when the grain size is small. For instance, in order to decode the most frequent 3000 monosyllabic English words at the level of the rime, a child needs to learn mappings between approximately 600 different orthographic patterns and 400 phonological rimes, far more than would be needed if the child could simply learn how to map 26 letters onto 26 phonemes. But relying solely on grapheme-phoneme correspondences leads to the inefficient recoding of English. In contrast, young learners of consistent languages can focus exclusively on the "small" psycholinguistic grain size of the phoneme without making many reading errors. Consistent feedback received in terms of achieving correct pronunciations will further reinforce the acquisition process. Psycholinguistic grain size theory takes these factors into account (p. 9)

Like Italian and Finnish, written music is extremely consistent. However, written music conveys a large amount of information per sign. A given musical note should be read not only as pitch and duration, but additional signs can modify it for articulation and loudness. Further, a musically literate person is also aware of that note in relation to other notes, not only vertically in terms of harmony but also horizontally, in terms of how the note contributes to a melodic phrase. Whatever size it is, the musical grain is complex.

Semiotics

The task of reading and writing music is one of translation between two semiotic systems (the visual and the aural). One problem with translation is that aspects of that translation seem to be arbitrary and therefore difficult to remember. For example, the

concepts of "up" and "down" in printed music appear arbitrary, if not downright backwards, to someone whose instrument has the higher notes nearer the floor and the lower notes nearer the ceiling (the guitar—or the cello, for that matter).

Furthermore, there may simply be some brain processing issues for people who have been identified as having dyslexia. According to Clark and Uhry (1995)people with dyslexia are often slow at what they call "Rapid Automized Naming," where people name what they see, such as naming the colors on successive cards. An analogous task in music would be to quickly name or play notes from music flashcards. Although Clark and Uhry don't mention that this is a semiotic translation task, it, indeed, is.

Finally, Beacham and Alty (2006) found that students with dyslexia had more trouble with not just text but diagrams and other media. They also theorized that multi-media presentations tend to overload a student's working memory and are not an effective means for teaching. This finding suggests that since students are different, they may need an array of *choices* about how to take in information. For instance, information about music theory can be presented verbally via a text, verbally via a recorded lecture, visually via text and diagrams, musically/aurally via recorded examples, and musically/visually via printed music. Since technology is so flexible, all the options can be offered in such a way that students can choose the media that work best for their own learning styles.

Levels

Like linguistic literacy, music literacy is a process that takes place at a minimum of two significant levels. At the lowest level, a person makes a connection between a printed note and a given pitch in the reading of melody. This would be analogous in linguistic literacy with knowing the sounds of the alphabet letters.

Rhythm is a relational system that has no analogy in language. Whether or not it gets the beat, a quarter note is always twice as long as an eighth note. A given performed rhythmic pattern can be written out correctly in a variety of ways, using any type of note as the basic beat and other notes in relation to the note that gets the beat. In other words, "long short short long short short" (assuming "long" is twice the length of "short") can be written with wholes and half notes, half notes and quarter notes, quarter notes and eighth notes, eighth notes and sixteenth notes, etc. The more voices in a piece of music, the more complexity there is in the rhythm not only because of the rhythm of each voice but also because of the interplay of rhythms between voices.

At a higher level are the patterns we hope music students will recognize: notes sounded simultaneously in chords, melodic patterns—scales and arpeggios, and common rhythmic patterns. Higher level understanding allows students gain musical meaning and therefore to "chunk" information.

Musical meaning is a memory aid. It is very difficult to write down a series of random notes. Musical patterns, from which musical meaning is derived, allows musicians to think about clusters or chunks of notes rather than individual notes. Chunking information means less information must be remembered. Rather than memorizing the dictation of *three* separate notes such as, E, G#, B, the person who recognizes the pattern thinks of only *one* thing: an E major chord. By remembering the E chord, he or she can derive the three notes. Furthermore, Tsukiura (2005) states that when people are trying to remember a list of words, they do better when the words are presented relationally, rather than just a list of random words. In other words, it is easier to remember a list of fruits rather than a list of words that have no relationship to each

other. Therefore, it makes sense to teach music theory concepts in a way that highlights the meaning-making processes of music, so the concepts and specifics become more memorable.

Dyslexia and Learning Disabilities

"Dyslexia" means "difficult or painful" reading. People who have this type of learning disability suffer because they do not learn in the same ways that those without dyslexia learn. Dyslexia is diagnosed when there is a significant discrepancy between a person's IQ and their actual reading ability. It is not uncommon for people with dyslexia to be very bright—and doubly frustrated at struggling with reading. Learning disabilities is a more general term that subsumes "dyslexia." Learning disabilities can include a range of problems, such as short term memory issues that make it difficult for students to learn new material. There are several possible deficits that a person with dyslexia and other learning disabilities might have.

Short Term Memory/Verbal Memory/Working Memory

According to Clark and Uhry (1995), some people have poor short term memories. They are not able to remember, for example, a string of digits. Kramer et al. (2000) suggest that people with dyslexia may have difficulty with verbal memory—learning lists of words and recalling them later. Geary et al, (2004) studied students with mathematical disabilities and found that their working memories were not able to handle large amounts of information. Memory issues might mean that a student would have difficulty remembering a sequence of musical notes. It is also likely that a student with short term memory deficits would have problems remembering information presented in

class and would need access to repetitions of that information.[3] Finally, music theory is very mathematical in nature; students' working memories may become easily overwhelmed.

Rapid Naming

According to Clark and Uhry (1995), "The length of time it takes to look at a visual stimulus and say its name is a good predictor of reading ability" (p. 28). As mentioned above, this is a translation exercise across semiotic systems. The child looks at a red card and says "red," translating visual stimulus into a linguistic label and then stating that label. Some people are naturally good at this and do it without thinking about it while others struggle with this. Yet crossing semiotic systems can be a critical aspect of music theory learning. Students need to be able to hear a chord progression and use the number system to write down or verbally express what they hear. They need to be able to see a melodic line and sing it or perhaps name the notes.

ADHD/ADD

People with Attention Deficit Hyperactivity Disorder (ADHD) or Attention Deficit Disorder (ADD—people who have problems concentrating but are not overactive) have difficulty focusing and may not be able to complete a long sequence of notes for that reason. Even a one page homework assignment may present challenges if it requires concentration to complete. Larger projects that require sustained effort may also be challenging to a person who has ADHD or ADD because they may not know how to break down the project into manageable bits. These problems are exacerbated if along

[3] I have a high school student with short term memory problems, Kayla. She tells me that hands-on teaching helps her to remember—when she can actually manipulate something. That's why she likes playing music. The other interesting aspect of Kayla's learning is that she is very good at figuring out technology. When I let her use a Palm Pilot, she figured out most of its functions within the space of a couple of hours. I believe that the structure of technology—with icons visible on a desktop showing the options—is something to explore in terms of creating assistance for people with learning disabilities.

with ADHD or ADD the student has a learning disability. Any assignment not only takes concentration, but it also takes a much longer time to complete, than for a person without a learning disability. This commitment of time can overwhelm a student and make it difficult for him or her to get started on the work. Students need strategies for breaking down assignments into manageable segments.

Acoustic Processing Difficulties

Clark and Uhry (1995) states:

> In a recent analysis of the spelling errors of children who are dyslexic but have received intensive remediation, Mary Kibel and T.R. Miles found persistent difficulty with a type of errors not found in spelling-age matched controls. The errors involved both cluster reduction (e.g., spelling *blend* as "bend") and substitution of phonologically confusable pairs (e.g., *e/a, b/d, r/l*). These errors are consistent with Tallal's theory that individuals with dyslexia experience difficulty processing rapid acoustic information. (p. 40)

As mentioned previously, Mather (2001) states that certain kinds of dyslexics have difficulty reproducing a melody that has been played. The student may not hear (that is, process through the hearing centers of the brain) all of the notes in a given sequence, whether the sequence is "vertical" (a series of chords—4 part harmony) or "horizontal" (a melody). It is possible that these students will need multiple repetitions at a slow tempo of this kind of material in order to be able to reproduce it or to cross semiotic systems and be able to write it down.

Listening Comprehension

Here's another interesting quote from Clark and Uhry (1995): "…historically, children described as dyslexic were found to have deficits in a range of oral language skills including listening comprehension." (p. 41).[4] They go on to qualify this statement somewhat (ADHD vs. dyslexia and that distinction's effect on research), yet comprehension is important to consider. First of all, these students may have trouble comprehending lectures and verbal instructions. They may need access to written instructions and/or repetition of lecture material. Secondly, musical comprehension is what music theory is all about. Music is far more than a collection of notes correctly played. Musical meaning lies in musical patterns such as chord sequences, in the use of key and key changes, in phrasing, in ornamentation, in melody, in rhythm, and in contrast between all musical elements. Students need to be good at comprehending music because it is only through comprehension that we can recognize patterns. Again, repetition may help these students.

Principles for Addressing Dyslexia and Learning Disabilities

The literature is replete with possibilities for helping students with learning disabilities.

Direct Instruction

Clark and Uhry (1995) state that students with dyslexia "do not learn *by osmosis*, as other children seem to do. Rather, they need direct, intensive, and systematic input from, and interaction with, the teacher," (p. 64) [italics original]. This means that

[4] My brother, who is dyslexic, and a student with learning disabilities I had in the Kodaly program both confirm this. They both have indicated that although their hearing acuity is normal, they often have problems comprehending what they hear. In the case of the student, I used the same strategies I would have used with a student with a hearing loss—I made sure she could see me as I spoke to the class so she could get as many cues as possible.

students may need to have what is “obvious” to other students actually explained to them. They may need access to repetitions of the explanations and opportunities to practice their understandings far beyond what other students need.

Time

Clark and Uhry (1995) suggest that students with this kind of trouble need more time for tasks. They also need more instructional time.

Pacing

These students become overwhelmed with informational overload, so instruction needs to be given at a pace students can handle.

Learning to Mastery

Students need to become automatic at what they do. Students with learning disabilities would need to have lots of extra practice on concepts so they can reach a level of mastery with it. Only when they have mastery can they then apply the concept appropriately. Many students can master a concept with just a few examples and a short collection of homework problems but students with learning disabilities will need more practice.

Feedback

While feedback helps all learners, it is critical for struggling learners. Clark and Uhry (1995) point out that feedback can be done using the Socratic method—asking the students questions about his or her response to help them figure out what they are doing right and what they need to work on.

Assessment

As I tell my students, assessment is part of the teaching cycle—teach, assess, plan. We plan for the next lesson based on our assessment of the most recent lesson. With struggling students, assessment is critical because it lets you know if the intervention is working and it can give a student hope to see their own progress. Also, it is useless to teach a higher level concept if the student does not understand the foundational concept.

Multisensory Techniques

While some authors argue for multisensory techniques (e.g., Clark and Uhry, 1995; Wadlington, et al., 1995), Beacham and Alty (2006) suggest that these students may have trouble with multimedia. Temple Grandin discusses this sort of problem in relation to people who have autism and suggests that teachers find the "channels" that are least "scrambled" with this population and use those channels—because some people with autism have trouble processing visual information while others have more trouble managing aural information. The same idea is probably workable with people who have learning disabilities. Computer technology is flexible enough that students can be given options as to how information is presented and can then choose to use the options that are most workable for them as individuals. Zvi and Axelrod (1996) describe a program at their university where textbooks are read out loud to students who have trouble with reading and notetakers are used in class for students who have trouble comprehending lectures. Textbooks can be read into mp3 files and made accessible on the computer; lecture notes could be posted on Blackboard and the lectures themselves can be recorded

on mp3 files and posted on Blackboard so students can listen to the information repeatedly.

Phonological Awareness

Linguistic readers have to make a connection between letters and their sounds. The equivalent in music would be to make connections between the note on the page and its sound on an instrument.

Developing Strategic Learners

According to Clark and Uhry (1995), linguistic readers are encouraged to use multiple cuing systems in order to read words. They should look not only at the sounds of the letters but also thinking about what would make sense in the context. Music students who struggle need to be aware consciously of the possible strategies for figuring out what they are reading or writing. They need to engage what they know about reading pitch but also what they know about musical patterns through music theory.

Proctor et al. (2006) and MacKay (1997) suggest that students with learning disabilities tend to use less effective study and learning strategies than students who do not have learning disabilities. Students who struggle need to be specifically taught how to study and to be given support as they develop stronger study habits and class-related learning behaviors (e.g., note taking). They may also need information about how textbook information is constructed.

Deavers and Brown (1997) report that students with dyslexia have a hard time using analogies to decipher unknown words. In other words, if I know the word “cat,” then by analogy, I should know “bat,” “fat,” and “mat.” Basically, as Lovett et al. (1994) points out, these students have a hard time transferring what they know in one situation to

a new situation. It is a good idea to help students learn to transfer information. For instance, much of what we know in one key applies to another (e.g., functions of scale degrees, chords, etc.). These students may need to have these transfer concepts taught directly instead of assumed.

Schneider and Ganshow (2000) suggest that in interactions with students who have dyslexia, that teachers use questions to guide students in developing concepts, rather than answering the students' questions. Questions lead students to construct knowledge rather than just to consume it. Given that students with learning disabilities may have difficulty comprehending an explanation, it makes more sense to ask questions and elicit the explanation from the student rather than just giving an explanation.

Breaking Down Tasks

Wadlington et al. (1995) suggests that students with learning dyslexia need to learn how to break down tasks into do-able parts. Marla Cilley, the Flylady, (flylady.net) helps adults to do this with home management tasks; she is an advocate of using a timer: working fifteen minutes and then taking a short break before going back to work for another fifteen minutes. This technique is especially helpful for students who have difficulty concentrating (ADD or ADHD).

Memory Problems

Students with learning disabilities may have difficulties with various aspects of memory—short term memory, working memory. They may need access to repetition of information and for learning units to be broken down into parts that do not overwhelm the working memory. For instance, in sight singing, one must not only process the written notes (pitch and rhythm) but then also remember the solfege syllables that

correspond to the scale degrees—which means figuring out the key and remembering which notes on the staff correspond to which syllables within that key. Further, because the solfege syllables are based on Latin syllables of a Gregorian chant, they seem to be arbitrary—rather like memorizing random words. In order to break down the task of sight singing, it might be a good idea to ask a student to read the rhythm only for several repetitions. Then the student can read the melody, perhaps using a number system (which is easier to memorize) instead of the solfege syllables.

Possibilities for Working With Music Students

Here are a number of possibilities for helping students become more proficient at reading and writing music. I have organized these by "problem" that a student might be having, as these strategies might well address those problems. Not every student will have every problem. Some problems are addressed in more than one subheading—this material was not so easy to organize.

Direct Instruction

Since students with learning disabilities do not learn information as automatically as other students (they do not transfer information and they do not learn as easily by inference), then direct instruction is necessary on most concepts. For instance, students who do not play keyboard instruments need to reorganize their ideas about pitch. Because of their need for direct instruction, they will need to have someone point this out. Perhaps they need to practice playing their instruments from lowest to highest note and vice versa, consciously thinking about low and high. They might need information on acoustics in order to help them remember that higher notes vibrate at higher cycles per second. They may also need to trace the melody in the air or, better yet, on a piece of

paper as they hear it, moving up when the melody goes up and then down when the melody goes down. The paper tracing can help them remember the contour of the melody as they begin to write it down.

Basic music concepts can be taught through power points that students could access as they need on Blackboard. This could include how the keyboard relates to the music staff (it's not necessarily obvious that right=high and left=low on the keyboard), and other basic concepts about music reading. As a matter of fact, all students entering the Conservatory could be given a diagnostic test to see if they have mastered enough basic information about music reading and writing to be successful in the standard music theory course. Students without learning disabilities who have not mastered this information could be given an on-line remedial course prior to taking music theory. Students with learning disabilities might be given not only the remedial information but they might take their music theory course in a class that is self-paced (this option is discussed below).

Time, Pacing, Learning to Mastery

Students with learning disabilities need more time both to learn information and to represent their learning in tests. It might be worthwhile to develop a computer-centered course for these students, where they can work at their own pace. In my experience teaching on-line courses, the best format for this situation is to have a set class time where students attend a computer lab and work individually on learning units that are posted on Blackboard. During this sort of class, the teacher does not lecture but rather monitors students as they work on-line, provides individual instruction to address students who are having difficulty with a particular concept, and scaffolds through

individual instruction the development of effective study strategies. Posted on Blackboard for each learning unit would be recordings of the textbook text and lectures, visual (as non-linguistic as possible) information about the concept, musical examples both in notation and recorded, lecture notes, practice problems for students to complete, and tests. It would also be ideal for each student to have access to an electronic keyboard and earphones (or the computer equivalent) so they can play and hear any music that they read. It is possible to write a grant to get wireless computers, a wi-fi hub, and electronic keyboards to make such a class possible. With a class like this, students can learn at their own pace to mastery, receiving individualize assistance where it is needed.

Feedback and Assessment

Whatever the learning situation, students with learning disabilities need immediate feedback. It is helpful to use questioning both to find out what the student understands and doesn't understand (assessment) and also to guide students toward constructing their own understanding. Furthermore, in assessing students, we need to consider the time they need (e.g., more time, more repetition of aural material on a test). These students might benefit from tests recorded on mp3 files so they can listen as often as they need in order to complete the assessment without disturbing other students.

Multisensory Techniques

Regardless of whether a special class can be set up for students with learning disabilities, materials posted on Blackboard can be of a variety of media so that students can select the materials that work for them. For instance, students might select mp3 files of textbook chapters read out loud, mp3 files of lectures, Microsoft Word files of lecture

notes, power point files of information depicted visually (non-linguistically) including sound samples.

Phonological Awareness

One goal is for students to learn to connect what they see in music notation with what they hear. They need both multiple opportunities to develop and practice this skill but also direct instruction about the importance of developing this skill. In other words, they will likely not intuit the significance of this skill the way students without learning disabilities are likely to do.

Developing Strategic Learners

In terms of music theory, music students should not only be able to reproduce written music vocally or on an instrument, but they should also be able to predict what is likely to happen in a piece of music they are sight-reading, based on meaning-making knowledge (e.g., knowledge of form, knowledge of the "grammar" of chord structures, etc.). For example, many fiddle tunes that I teach my students have repetitive structures. After I have taught part of a tune, if it has some kind of repetitive structure, I will ask students to guess what is coming next, to get them paying attention to the structure of the music they are playing. Students who are reading music can be asked to guess what is coming next (e.g., if they have just played the exposition of sonata-allegro form, then the development section is coming next; if they have played A and B of ABA form, then A is coming back next; if they have played the penultimate chord, e.g., a V, then the next chord will probably be a I unless it is a deceptive cadence).

Further, students should be taught to look at the music before they sight-read or sight-sing. They may need to be taught directly some strategies for reading music, such

as looking for scales or skips in the music and predicting what those patterns will sound like.

Students with learning disabilities will also need to learn study strategies. They need to be directly taught that when they sit down to do their music theory homework, that they need to log into Blackboard and review the class material using a method of their own choice (listen to the lecture, read the lecture notes) and they need to access the textbook either by reading it or by listening to it. They may need some of the supplemental materials that can be put on Blackboard (e.g., power points explaining certain concepts).

In addition to being taught these study strategies one time in class, students may need to be reminded of them. This can be done individually in class and it also can be done through the announcement feature on Blackboard, as well as a Course Document that outlines options for studying. Being told something one time is usually not effective with this population—they need to be reminded and encouraged in this direction.

Since students with learning disabilities appear to generalize less than students who don't have learning disabilities, one cannot assume that students will apply concepts learned in one area to concepts one is learning in another area. Students who learn to study effectively in their music theory class through all the scaffolding provided will still need support in other classes to develop appropriate study skills. Students who learn to navigate scale degrees and chord structures in one key will need help in learning to navigate in other keys.

Finally, an effective teaching strategy for students with learning disabilities is to use questions to help them to construct their understanding of music theory. For instance,

instead of telling students that there is a half-step between the 3rd and 4th degrees and 7th and 1st degrees of a major scale, it will take more time but students will retain the information longer if they are led to discover this. To do this, one would play the major scale and get them to play it by ear on a keyboard. The first part of this lesson would be to play the major scale across a lot of keys and to encourage the students to start on different keys and just play by ear. Then, they could write down the names of the notes they have played by ear in a particular key (temporary stickers with the names of notes on the white keys of the keyboard would reduce the load on working memory for this task), using the rule that every scale has to have all seven alphabet letters (which keeps students from using double sharps or double flats—if the sharp key doesn't work, they need to use the flat key). After they have written down the names of notes in several major scales, they can be asked to review the scales and notate the half steps. After they have notated the half steps, they can be led through questioning to discover where the half steps are in major scales. They can then predict the structure of a major scale in a new key by writing down what the notes should be and then playing it to see if it is right.

Breaking Down Tasks

A critical study strategy to develop is that of being able to break down tasks into do-able parts and then to develop the self-discipline to complete those tasks. Students might benefit from checklists of items to study for an upcoming test and from being encouraged multiple times to use a timer so they can focus for a small amount of time, take a break, and then come back to the task for another period of focus.

Memory Problems

One way that might help students to develop their short term memory for musical sequences is the electronic game, Simon. That game begins with a single note. When the player plays that note, Simon plays the first note and adds a second. There are only four notes on the game. Perhaps some computer whiz could program a similar type of game only expanding the number of notes available.

A second remedy would be to teach students to use music theory knowledge to chunk what they hear. Remembering that a sequence is the last half of a G major scale is a lot easier than remembering four individual notes. Students who appear to have short term memory difficulties need to be especially thoughtful about what they hear and to focus on patterns more than notes.

Another remedy would be to lessen the amount of information students need to handle in their minds as they do musical tasks. As mentioned above, students might separate rhythm from pitch in sight singing and demonstrate each skill separately until they become proficient at the separate skills. Instead of using solfege syllables, students might use numbers to indicate scale degree (although there remains the problem of indicating sharps and flats; perhaps these could be done by hand sign—pointing up for a sharp while singing the correct scale degree number sharp and pointing down for a flat while singing the correct pitch).

When taking music theory tests that include dictation, students might benefit from using mp3 players with the musical examples recorded on them so they can hear the examples privately as often as they need to in order to complete the test.

Rapid Naming

I wonder if there might be some students who do not write music very well because they do not read it very well. I also wonder if extended practice with flashcards and musical notes to be named and played would help at all.

Acoustic Processing Difficulties

Students who tend to skip notes in dictation may need to count the number of notes being dictated, even before they start writing them out. They could place a dot on the top of the staff for each note they hear. The dots would remind them of how many notes they need to write out. The dot technique could be combined eventually with drawing the contour of the melody—dots could be higher or lower in relation to pitch.

Help students become aware of how the missed notes can be chunked. Students should listen at least for scalar and arpeggiated patterns. Perhaps at first they should just identify when they hear those patterns. Then they can try for the first note of the pattern and learn how to extrapolate from that first note.

Conclusion

People who have learning disabilities become frustrated and discouraged. With appropriate tutoring, however, they can learn.

Ideally, an appropriate classroom for these students would be equipped with keyboards and computers for each student. Such a situation would not only work for students with learning disabilities but also gifted students who might want to work at a pace that is faster than standard instruction.

While having a dedicated classroom for this kind of instruction is not currently realistic, a grant could be written for laptop computers, small MIDI keyboards,

microphones, headphones, a wi-fi hub, and a cart to carry all this equipment so that any classroom in the wi-fi area can be used for individualized instruction. Such equipment could be used ultimately with other classes as well as music theory (e.g., music history). With this kind of equipment and this model of instruction, Capital's conservatory could distinguish itself as a place where students with learning disabilities and musical talent can thrive and learn. This paper can serve as the foundation for the writing of such a grant.

Further, establishing diagnostic testing before students' freshman year and a remedial theory course on-line would increase the success rate of many students in Capital's music theory courses. I believe this model is used in the English Department and the Math Department of many universities; students who are not capable of doing college-level English or Math are asked to take non-credit remedial courses before undertaking the credit-bearing English or Math.

In the meantime, Blackboard can be used to supplement the present class arrangement and to give students access to textbook, classroom lecture, and background information that they might be missing.

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